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☐ 1. Document ID: US 6532026 B2

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L6: Entry 1 of 8 File: USPT Mar 11, 2003

US-PAT-NO: 6532026
DOCUMENT-IDENTIFIER: US 6532026 B2
**** See image for Certificate of Correction ****

TITLE: Adjustment method of dot printing positions and a printing apparatus

DATE-ISSUED: March 11, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Takahashi; Kiichiro	Kawasaki			JP
Otsuka; Naoji	Yokohama			JP
Nishikori; Hitoshi	Inagi			JP
Iwasaki; Osamu	Tokyo			JP
Teshigawara; Minoru	Urawa			JP
Chikuma; Toshiyuki	Tokyo			JP

US-CL-CURRENT: 347/41; 347/19, 347/43, 358/504

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 2. Document ID: US 6330075 B1

L6: Entry 2 of 8 File: USPT Dec 11, 2001

DOCUMENT-IDENTIFIER: US 6330075 B1
**** See image for Certificate of Correction ****
TITLE: Image processing method and apparatus

Application Filing Date (1):
19960726

Detailed Description Text (78):
In order to express a 1200-dpi CMYK dot pattern by 300 ppi, 4.times.4.times.4=64 bits are required. If a representative color code is composed of eight bits, data

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compression to 8/64=1/8 is possible. Among the 2.sup.64 output patterns mentioned above, the number of identifiable is fairly small. In addition, there are disparities due to positional precision, dot diameter and dot density (shading) of the output dots. In view of these facts, if suitable representative colors are selected, the output image will be almost unchanged even if the number of representative colors is made fairly small. On the other hand, reducing the number of representative colors to a significant degree makes it possible to reduce the number of items of data transmitted over the transmission line 201. This not only makes it possible to curtail transmission time but also makes it possible to greatly reduce the buffer capacity needed by the H-V converter 71 and to lower the cost of the printer. In regard to colors other than the representative colors, these are expressed by a combination of representative colors by means of error diffusion at 300 dpi mentioned above.

Current US Original Classification (1):
358/1.9

Current US Cross Reference Classification (1):
358/518

Current US Cross Reference Classification (2):
358/523

☑ 3. Document ID: US 6170930 B1

L6: Entry 3 of 8 File: USPT Jan 9, 2001

DOCUMENT-IDENTIFIER: US 6170930 B1
TITLE: Method for producing gradient tonal representation and a printhead for producing the same

Application Filing Date (1):
19970825

Current US Cross Reference Classification (1):
358/3.14

CLAIMS:

1. A method of producing a gradient tonal representation of an image on a physical medium using ink dot printing, comprising the steps of:

printing representations of image areas having intensities within a first, continuously variable, defined intensity level range by forming at respective dot locations, ink dots each having an intensity level that is selectively and continuously variable over a range representing said first defined intensity level range, by adjusting individual ink dot sizes over a continuous range of dot sizes d1 to d2;

printing representations of image areas having intensities within a second, continuously variable, defined intensity level range by forming at respective dot locations, ink dots each having an intensity level that is selectively and continuously variable over a range representing said second defined intensity level

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range, by adjusting individual ink dot sizes over a continuous range of dot sizes d3 to d4; and

printing representations of image areas having intensities within a third, discretely variable intensity level range intermediate the first and second intensity level ranges by forming at respective dot locations, ink dots each having a size selected from a predetermined number of discrete size values that are either not greater than d1 or not less than d3;

wherein, in sequence, said first, third, and second intensity level ranges represent image areas of increasing intensity levels and the dot sizes increase from d1 to d2 to d3 to d4.

16. A method of producing a gradient tonal representation of an image on a physical medium using ink dot printing, comprising the steps of:

printing continuous tone representations of image areas having intensities within a first defined intensity level range by forming at respective dot locations, ink dots each having an intensity level that is selectively and continuously variable over a range representing said first defined intensity level range, by adjusting individual dot sizes within a continuous range d1 to d2 and at each dot location forming a defined plurality of dots;

printing continuous tone representations of image areas having intensities within a second defined intensity level range by forming at respective dot locations, ink dots each having an intensity level that is selectively and continuously variable over a range representing said second defined intensity level range, by adjusting individual dot sizes within a continuous range d3 to d4 and forming at each dot location a number of dots less than said defined plurality of dots;

printing non-continuous tone representations of image areas having intensities within a third intensity level range intermediate the first and second intensity level ranges by forming at respective dot locations, ink level ranges by forming at respective dot locations, ink dots each having a size selected from a predetermined number of discrete size values that are either not greater than d1 or not less than d3;

wherein, in sequence, said first, third and second intensity level ranges represent image areas of increasing intensity levels and the dot size images increase from d1to d2 to d3 to d4.

☐ 4. Document ID: US 5768411 A

L6: Entry 4 of 8 File: USPT Jun 16, 1998

DOCUMENT-IDENTIFIER: US 5768411 A
TITLE: Dispersed-dot dither with improved light-color smoothness

Application Filing Date (1):
19960226

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Brief Summary Text (9):
On the other hand, most computer-driven printing devices, such as laser, dot-matrix, and ink-jet printers, operate in a binary fashion: the output medium is divided into a number of pixels, and the printing device can only print a dot at the pixel location or leave it blank: there ordinarily is no dot-size or intensity choice. In the case of monochrome printers, all of the dots are printed in a single color. In a color printer, the same dot can be printed with various combinations of the printer's basic color components (e.g. cyan, magenta, and yellow) but, again, each component color has only two values: printed or not.

Current US Cross Reference Classification (1):
358/535

☑ 5. Document ID: US 4985779 A

L6: Entry 5 of 8 File: USPT Jan 15, 1991

DOCUMENT-IDENTIFIER: US 4985779 A
TITLE: Improved method and apparatus for generating halftone images

Application Filing Date (1):
19890919

Brief Summary Text (15):
According to U.S. Pat. No. 4,499,489 the decision about exposure or non-exposure of the film at the location of an exposure dot depends on the result of a greater-smaller comparison between the image value representing the desired dot size and the function value R of a screen function R=f(x,y), which is periodic in two dimensions and has periods equal to the dimensions of the screen mesh in the x- and y- directions.

Current US Original Classification (1):
358/3.1

Current US Cross Reference Classification (2):
358/3.2

Current US Cross Reference Classification (3):
358/3.23

☐ 6. Document ID: US 4713746 A

L6: Entry 6 of 8 File: USPT Dec 15, 1987

DOCUMENT-IDENTIFIER: US 4713746 A
**** See image for Certificate of Correction ****

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TITLE: Method for forming pictures

Application Filing Date (1):
19861223

Detailed Description Text (4):
In fact, dots are two-dimensionally arranged on a recording medium. But, for a space-frequential analysis it may be considered as one-dimensional arrangement on a rectilinear line passing through the center of dots. The density distribution is represented by f(x) in FIG. 1 wherein x is the coordinate of position of dot on the straight line and y is the density of optical reflection at the position x. The reflection density of the recording medium (such as paper) is denoted by a.sub.0 (the density of optical reflection: -log a.sub.0), the reflection density of color dot (including both of colored dot and non-colored dot) by a.sub.1 (the density of optical reflection: -log a.sub.1), the dot diameter by b and dot pitch is denoted by T. And a=a.sub.0 -a.sub.1.

Current US Cross Reference Classification (2):
358/3.1

Current US Cross Reference Classification (3):
358/500

Current US Cross Reference Classification (4):
358/502

☐ 7. Document ID: US 4638373 A

L6: Entry 7 of 8 File: USPT Jan 20, 1987

DOCUMENT-IDENTIFIER: US 4638373 A
TITLE: Method and apparatus for improving gray scale resolution in an ink jet printing system

Application Filing Date (1):
19850306

Detailed Description Text (7):
When a detected or measured color intensity level has a value falling between two successive integer value intensity levels, the detected or measured intensity level is either rounded up or down to the nearest integer value and consequently the color intensity produced at the corresponding associated pixel location does not accurately represent the measured color intensity. In accordance with the present invention, the gray scale resolution available from a pixel having a fixed number of potential dot positions that can be printed with substantially equal sized dots to represent a desired color intensity for a given area of the graphic comprising two or more adjacent or side-by-side pixels can be increased to produce a color intensity having a dot level value falling between two successive integer values as explained hereinbelow.

Current US Original Classification (1):
358/3.03

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Current US Cross Reference Classification (5):
358/296

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

☐ 8. Document ID: US 3977007 A

L6: Entry 8 of 8 File: USPT Aug 24, 1976

DOCUMENT-IDENTIFIER: US 3977007 A
TITLE: Gray tone generation

Application Filing Date (1):
19750602

Brief Summary Text (4):
It has long been known that shades of gray can be produced in ink jet recording by various techniques. U.S. Pat. No. 3,604,846 granted to D. Behane et al. on Sept. 14, 1970, teaches the technique in which a matrix of, for example, nine dots is formed with each dot being of the maximum density of the ink jet mechanism. In the Behane et al. patent a lighter gray shade is formed by recording or printing fewer dots within a matrix area. A darker gray shade is produced by recording more dots within the matrix area. All dots have the same size or density. U.S. Pat. No. 3,373,437, granted on Mar. 12, 1968, to R. G. Sweet teaches the formation of gray shades by depositing different numbers of drops at the various dot locations on the copy to vary the dot size and thus darkness or tonal density. Both of these systems experience some limitation.

Current US Cross Reference Classification (4):
358/3.01

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWMC | Draw De

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Term	Documents
(5 AND 1).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	8
(L5 AND L1).PGPB,USPT,EPAB,JPAB,DWPI,TDBD.	8

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